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Effectiveness of mKRISHI® Personalised Advisory on Water and Soil (PAWS) in dissemination of agricultural information in north-western Himalayan region

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ABSTRACT

The effectiveness of an extension system referred to its ability to meet the farmer needs in providing the new technology which suits to their conditions and results in better production. Recently the demand for information on agricultural practices and technology among the farmers is increasing day by day but fulfilment of these demands exclusively by public agricultural extension system is limited. To address this challenge, information communication technology (ICT) has the immense role in supplementing the extension system. Among the ICT tools, mobile phone, because of its affordability, accessibility, minimum skill requirement, widespread network etc., has emerged as important tool for information and knowledge dissemination to the smallholder and marginal farmers. But it is necessary to study how effective they are in achieving the respective objectives.The present investigation was conducted to study the effectiveness of mKRISHI® PAWS (Personalised Advisory on Water and Soil) in Dehradun district of Uttarakhand state. An ex-post facto research design was used for this study. Total 136 messages were sent to the respondents. The data was collected from 240 beneficiary farmers of the north-western Himalayan region. The effectiveness of the mKRISHI® PAWS in technology advisory and delivery services were measured by developing an effectiveness index for the purpose. Results showed that 93.8% of farmers perceive that quality of information regarding the latest NRM technologies in soil and water conservation was excellent and 83.75% of the farmers felt that the information regarding the latest NRM technologies in soil and water conservation was appropriate to their condition. The study revealed that the extension services delivered by mKRISHI® PAWS were found to be highly effective by majority of the farmers. 34.58% farmers perceived that the mKRISHI® PAWS was very highly effective as a mean of getting their information needs.

Key words*:* Effectiveness, ICT, mKRISHI® PAWS (Personalised Advisory on Water and Soil), North-western Himalayan region

Indian agriculture is the pivotal sector for ensuring food and nutritional security, sustainable development, poverty alleviation and it contributes 17% to the country's Gross Value Added (MoAFW 2017). During the 21st century, agriculture sector is witnessing radical changes and challenges at national and global level. The slow growth observed in the agriculture sector is causing concerns for the future food and nutritional security of the country. Further, Indian agricultural growth rate and the productivity remains low due to factors like declining of natural resource base, increasing fragmentation of holdings, frequent climatic variations, rising input costs and post-harvest losses (Mittal 2012). The demand for information on agricultural practices and technology among the farmers is increasing day by day but fulfilment of these demands exclusively by public agricultural extension system is limited. Public extension services are also facing acute shortage of staff to timely deliver information to the farmers and it is supply driven rather than demand driven (Sulaiman 2005). The current extension worker to farmer ratio is very wide in India i.e. 1:5000 whereas in case of China it is 1:625 (Ragasa *et al* 2013). In India over 59% of the farm households received no support from either government or private extension services (NSSO 2016). The emerging challenges and opportunities call for a paradigm shift in the innovation driven agricultural research system to connect inventions with all the stakeholders in the entire food supply chain

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(ICAR Vision 2030). The advent of information and communication technologies (ICTs) in agricultural extension will provide needed impetus to agricultural sector and ICTs can complement the traditional extension system for "Knowledge Resource" delivery to the millions of the farmers (Saravanan 2010). ICTs in agriculture have the potential to facilitate greater access to information that drive or support knowledge sharing. In the past decade, ICT projects in Indian agriculture have emerged, either substituting or supporting extension services by providing farmers with access to agricultural information. ICTs essentially facilitate the creation, management, storage, retrieval, and dissemination of any relevant data, knowledge, and information that may have been already processed and adapted (Batchelor 2002, Chapman and Slaymaker 2002, Rao 2007, Heeks 2002). In the past, television and radio were the main electronic broadcast technologies used to reach rural communities; however, in the past two decades, Internet and mobile-based channels have emerged. ICTs now include computer-based applications and communication tools such as social media, digital information repositories (online or offline), and digital photography and video, as well as mobile phones (Balaji *et al.* 2007).

At present, there are many ICT projects which are serving Indian agriculture by using different ICT tools (mobile, internet, audio, video, kiosks, etc.). The approach adopted by mKRISHI® is different from all other projects. The mKRISHI® PAWS (Personalised advisory on Soil and Water) platform, developed by Tata Consultancy Services in 2015-16 in collaboration with ICAR-Indian Institute of Soil and Water Conservation, Dehradun, enables farmers to access best practice information and agricultural experts through low-cost mobile phones using SMS. In order to meet the relevant and location specific information requirement for farming, it is necessary that message should be generated in a particular region with the involvement of the target people. In this way mKRISHI® PAWS follows participatory approach in production of the SMS by involving farmers. Keeping this in view, the study was conducted to assess the effectiveness of mKRISHI® PAWS in dissemination of agricultural information to the farmers.

MATERIALS AND METHODS

The study was conducted in Raipur, Vikas nagar and Kalsi blocks of Dehradun district in Uttarakhand. Three villages from each block were selected randomly. Simple random sampling was used for the selection of respondents. An ex-post facto research design was used for the study. The mKRISHI® PAWS (Personalised advisory on Soil and Water) platform, was used for sending messages to the farmers. In total, 136 specific messages related to different agricultural aspects were sent to the registered farmers and other stakeholders including extension workers, input dealers and development functionaries. forty-four messages related to plant protection were developed and sent to the farmers through mobile followed by crop production technologies and Soil and water conservation aspects. Important and urgent messages related to weather and flagship programmes were also highlighted through flagging the message in PAWS app. Main focus was given to Personalised Advisory on Water and Soil (PAWS). The relevant data was collected from 240 subscribed farmers of mKRISHI® PAWS. The information was obtained with the help of structured interview schedule developed on the purpose of the study. The effectiveness was measured by effectiveness index developed for this purpose. To measure the effectiveness of mKRISHI® PAWS, an index was developed, which had five dimensions, i.e. timeliness of information, ability to understand the information, quality of information, appropriateness of the technology and satisfaction of farmers. These dimensions are described below:

Timeliness of information: It referred to the services provided to the farmers by the mKRISHI® PAWS at the appropriate time (move at) in terms of seasonality of the crops grown. The perception of the farmers about timeliness of information was collected through the schedule on a five-point continuum.

Appropriateness of the technology: It was operationally defined as suitability of the technological messages provided by the mKRISHI® PAWS based on the farming conditions and climate in a particular region. The perception of the farmers about appropriateness of the technology was collected through the schedule on a five-point continuum.

Quality of information: It was operationally defined as the degree or level of excellence of the information provided by mKRISHI® PAWS and perceived by the farmers according to their farming conditions and climate in particular region. The perception of the farmers about quality of information was collected through the schedule on a five-point continuum.

Ability to understand the message: The ability to understand the information was operationally defined as the degree up to which the message conveyed by mKRISHI® system was clear and understandable by farmers. The perception of the farmers about ability to understand the message was collected through the schedule on a five-point continuum.

Satisfaction of farmers: The farmers' satisfaction was operationally defined as the perceived need contentment acheived by the utilization of services provided by mKRISHI® PAWS. The perceptions of the farmers about their satisfaction were obtained by mKRISHI® PAWS on a five-point continuum scale.

Effectiveness index: Effectiveness of the services of mKRISHI® PAWS referred to their ability to meet the farmer needs in providing the new technology which suits their conditions and results in better production and higher income. It was measured through index developed for the study which consists of all the above mentioned components

$$\text{Effectiveness index} = \frac{T1\times W1 + AT\times W2 + Q1\times W3 + UM\times W4 + SF\times W5}{W1+W2+W3+W4+W5} \times 100$$

where, TI= Timeliness of information, AT= Appropriateness

of technology, QI= Quality of information, UM= Ability to understandthe message, SF= Satisfaction of farmers, W1=Weightage for Timeliness of information, W2= Weightage for Appropriateness of technology, W3= Weightage for Utility of information, W4= Weightage for Ability to understand the message, W5= Weightage for Satisfaction of farmers.

RESULTS AND DISCUSSION

Results of the study are presented and discussed under the broadheads; Timeliness of information, Appropriateness of technology, Quality of information, Ability to understand the message and Satisfaction of farmers.

Table 1 represent the frequency and percentage of response of the farmers to the timeliness of the services. It showed that 81.25% of farmers perceived that information regarding the latest package of agronomical practices for hilly regions was provided in advance of the season while 18.75% of framers perceived that it was provided at the time of use of technology to the particular cropping season. All the respondent farmers assumed that information regarding the latest NRM technologies in soil and water conservation was provided in advance. In case of technological advisory in hill based horticulture, 72.50% of farmers responded that the advisory services were provided in advance of the season while 27.50% of farmers told that it was provided at the time of usage of technology during cultivation of the crop. Regarding the crop protection technologies, 77.5% of farmers felt that the services were at the time of usage of technology in the cropping season and 22.50% of farmers responded that the services are provided in advance. For the soil health card/nutrients based information, 53.8% of farmers perceived that the information were provided in advance and 40.41% of farmers responded it was provided at the time when technology was to be used. Almost (99.58%) all the farmers perceived that information needs were fulfilled in advance with regard to weather.

Appropriateness of the technology provided by mKRISHI® PAWS: Table 2 represent the frequency and the percentage of the farmers regarding the appropriateness of the technology. It characterized that 79.58% of farmers perceived that the latest package of agronomical practices for hilly regions provided by mKRISHI® PAWS was highly appropriate to their field situation and 20.41% of farmers perceived that it was appropriate for their location. It also showed that 83.75% of the farmers felt that the information regarding the latest NRM technologies in soil and water conservation was appropriate to their condition while 16.25% of farmers felt it was moderately appropriate for their situation. About technological advisory in hill based

Table 1 Timeliness of the messages sent through mKRISHI® PAWS

(N=240)

Services under PAWS	FIA		IA		ATUT		AS		WTBO	
	(f)	%	*(f)*	%	*(f)*	%	*(f)*	%	*(f)*	%
Latest Package of Agronomical Practices for hilly regions	0	0.00	195	81.25	45	18.75	0	0.00	0	0.00
Latest NRM Technologies in soil and water conservation	0	0.00	240	100	0	0.00	0	0.00	0	0.00
Technological Advisory in hill based horticulture	0	0.00	174	72.5	66	27.5	0	0.00	0	0.00
Crop Protection technologies	0	0.00	54	22.50	186	77.5	0	0.00	0	0.00
Soil Health Card/Nutrients based information	0	0.00	143	59.58	97	40.41	0	0.00	0	0.00
Weather Information	0	0.00	239	99.58	1	0.41	0	0.00	0	0.00

FIA: Far in Advance, IA: in advance, ATUT: at the time of use of technology, AS: after the season, WTBO: When tech. became obsolete

Table 2 Appropriateness of the technology provided by mKRISHI® PAWS (N=240)

Services under PAWS	HA		A		MA		SWA		NAA	
	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)
Latest Package of agronomical Practices for hilly regions	191	79.58	49	20.41	0	0.00	0	0.00	0	0.00
Latest NRM Technologies in soil and water conservation	0	0.00	201	83.75	39	16.25	0	0.00	0	0.00
Technological Advisory in hill based horticulture	165	68.75	75	31.25	0	0.00	0	0.00	0	0.00
Crop Protection technologies	186	77.5	54	22.5	0	0.00	0	0.00	0	0.00
Soil Health Card/Nutrients based information	124	51.66	116	48.33	0	0.00	0	0.00	0	0.00
Weather Information	130	54.16	110	45.83	0	0.00	0	0.00	0	0.00

HA: Highly Appropriate, A: Appropriate, MA: Moderately Appropriate, SWA: Somewhat Appropriate, NAA: Not at all Appropriate

Table 3 Quality of information provided by mKRISHI® PAWS (N=240)

Services under PAWS	Excellent		Very good		Good		Moderate		Poor	
	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)
Latest package of agronomical Practices for hilly regions	183	76.3	48	20.0	9	3.75	0	0.00	0	0.00
Latest NRM Technologies in soil and water conservation	225	93.8	4	1.70	11	4.60	0	0.00	0	0.00
Technological Advisory in hill based horticulture	156	65.0	76	31.7	8	3.3	0	0.00	0	0.00
Crop Protection technologies	183	76.3	49	20.4	8	3.3	0	0.00	0	0.00
Soil Health Card/Nutrients based information	122	50.8	111	46.3	7	2.9	0	0.00	0	0.00
Weather Information	124	51.7	107	44.6	9	3.8	0	0.00	0	0.00

horticulture, 68.75% of farmers believed that it was highly appropriate in their situation while 31.25% of farmers believed that it was appropriate in their condition. With respect to weather based information, 54.16% of farmers believed that it was highly appropriate in their situation while 45.83% of farmers believed that it was appropriate in their condition.

Quality of information

Table 3 represent the frequency and the percentage of the farmers regarding the quality of information provided by mKRISHI® PAWS. It characterized that 76.3% of farmers perceived that the quality of information regarding latest agronomical package of practices for hilly regions provided by mKRISHI® PAWS was excellent while 20% farmers perceived that it was very good followed by 3.75% perceived it as good. It also showed that 93.8% of farmers perceive that quality of information regarding the latest NRM technologies in soil and water conservation was excellent while 1.70% farmers felt it was very good followed by 4.60% perceived that it was good. Regarding quality of weather related information 51.7% of farmers perceived it excellent while 44.6% felt it was very good and 3.8% felt it was good. Information on latest agronomical package of practices and NRM technologies were developed by concerned experts after in-depth field level survey. Weather related information was retrieved from Indian Meteorological Department (IMD). Messages were very simple and clear.

Ability to understand the message

Table 4 represents the response of the farmers to the ability to understand the message provided by the mKRISHI®. The language of text message is very clear and understandable showed that 70.8% farmers strongly agreed with it, 19.2% farmers agreed with it and 10% farmers' were undecided about it. Regarding technical term used in text message easy to understand showed that 89.2 per cent farmers strongly agreedwith it, 1.7% farmers agreed with it, 9.2% farmers were undecided about it. In case of Information about disease and pest management is easy to understand, adopt and helps in decision making 47.1% farmers strongly agreed with it, 42.9% farmers agreed with it and 10% farmers were undecided about it.

Satisfaction level of farmers from the mKRISHI® PAWS service

Table 5 depicts frequency and percentage of response of the farmers to the satisfaction level from the services of

Table 4 Ability to understand the message provided by mKRISHI® PAWS (N=240)

Services under PAWS	Strongly agree		Agree		Undecided		Disagree		Strongly disagree	
	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)
Language of text message is clear and understandable	170	70.8	46	19.2	24	10.0	0	0.00	0	0.00
Technical term used in text message easy to understand	214	89.2	4	1.7	22	9.2	0	0.00	0	0.00
Content of text message provided by mKRISHI® is clear and understandable	130	54.2	73	30.4	26	10.8	11	4.60	0	0.00
Information about weather and market is easy to understand, adopt and helps in taking decision	155	64.6	52	21.7	24	10.0	9	3.8	0	0.00
Voice message delivered by mKRISHI® are clear	102	42.5	111	46.3	21	8.8	6	2.5	0	0.00
Information about disease and pest management is easy to understand, adopt and helps in decision making	113	47.1	103	42.9	24	10.0	0	0.00	0	0.00

Table 5 Satisfaction level of the farmers (N=240)

Services under PAWS	HNF		NFFS		NFAS		NFLS		NNF	
	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)	(*f*)	(%)
Latest Agronomical Package of Practices for hilly regions	0	0	193	80.41	47	19.58	0	0.00	0	0.00
Latest NRM Technologies in soil and water conservation	238	99.16	2	0.83	0	0.00	0	0.00	0	0.00
Technological Advisory in hill based horticulture	0	0	201	83.75	39	16.25	0	0.00	0	0.00
Crop Protection technologies	0	0	200	83.33	40	16.66	0	0.00	0	0.00
Soil Health Card/Nutrients based information	0	0	143	59.58	97	40.41	0	0.00	0	0.00
Weather Information	0	0	157	65.41	49	20.41	34	14.16	0	0.00

HNF: Hopeful of Need fulfillment in Future, NFFS: Need is fulfilled with full Satisfaction, NFAS: Need is fulfilled with Average Satisfaction, NFLS: Need is fulfilled with Least Satisfaction, NNF: No Hope of Need fulfillment, f=frequency, %=percentage

the mKRISHI® PAWS. It showed that 80.41% of farmers perceived that their needs were fulfilled with full satisfaction with regard to latest agronomical package of practices while 19.58% of farmers assumed that their needs were fulfilled with average satisfaction. About the latest NRM technologies in soil and water conservation, 99.16% of farmers assumed that their needs will be fulfilled in future and 0.83% of farmers felt that their needs were fulfilled with full satisfaction. 83.75% of farmers observed that their needs were fulfilled with full satisfaction with regard to the technological advisory in hill based horticulture while 16.25% of farmers were felt that need is fulfilled with average satisfaction. While considering the crop protection technologies, 83.33% of farmers perceived that their needs were fulfilled with full satisfaction and 16.66% of farmers felt that the needs were fulfilled with average satisfaction. 59.58% of farmers believed that their needs were fulfilled with full satisfaction in concern with the soil health card/ nutrients based information while 40.41% of farmers felt that their needs were fulfilled with average satisfaction. 65.41% of farmers perceived that their needs were fulfilled with full satisfaction with regard to weather information while 20.41% farmers assumed that their needs were fulfilled with average satisfaction and 14.16% of farmers with least satisfaction in the same concern.

Effectiveness of the mKRISHI® PAWS services

Effectiveness of the services of mKRISHI® PAWS was operationalized in terms of five components, i.e. a) timeliness of information, b) appropriateness of technology, c) quality of information, d) ability to understand the message and e) satisfaction of farmers.

Categorization of farmers based on timeliness of the information provided by mKRISHI® PAWS

Table 6 shows that the majority of the total farmers observed that they got the information of the technology in advance of the season of the crop (46.25%) while 22.5% of farmers perceived that they got technology related to the crop when technology loses its newness.

Categorization of farmers based on appropriateness of the technology provided by mKRISHI® PAWS

Table 7 shows that 49.16% of the total farmers experienced that the technology provided to them were highly appropriate to their field situation. It also signified that 18.75% of the total farmers experienced that the technology given to them were moderately appropriate to their condition followed by 17.08% of farmers perceived it was appropriate to their field situation.

Categorization of farmers based on quality of information provided by mKRISHI® PAWS

Table 8 shows that 65% of the total farmers believed that quality of information was excellent followed by 25% of the total farmers who believed that quality of information

Table 6 Distribution of farmers based on timeliness of the information (N=240)

Category of Timeliness	Class score	*f*	%
When technologies become obsolete	66.66-70	33	13.75
When technology loses its newness	70-73.33	54	22.5
At the time of usage of technologies	73.33-76.66	41	17.08333
In advance	76.66-80	111	46.25
Far in advance	80-83.33	1	0.416667
Mean		76.51	
Standard deviation		3.86	

Table 7 Distribution of farmers based on Appropriateness of the technology (N=240)

Category of timeliness	Class score	*f*	%
Not at all appropriate	80-84	13	5.41666667
Somewhat appropriate	84-88	23	9.58333333
Moderately appropriate	88-92	45	18.75
Appropriate	92-96	41	17.0833333
Highly appropriate	96-100	118	49.1666667
Mean		94.22	
Standard deviation		5.33	

Table 8 Distribution of farmers based on quality of information (N=240)

Category of timeliness	Class score	*f*	%
Poor	60-68	7	2.916667
Moderate	68-76	4	1.666667
Good	76-84	13	5.416667
Very good	84-92	60	25
Excellent	92-100	156	65
Mean		93.06	
Standard deviation		8.31	

was very good.

Categorization of farmers based on ability to understand the message provided by mKRISHI® PAWS

Table 9 shows that majority of farmers had very easily understood the information provided by mKRISHI® PAWS (52.5%) whereas 31.25% farmers had easily understood theinformation provided by mKRISHI® PAWS.

Categorization of farmers based on satisfaction level of farmers

Table 10 shows that 45% of the total farmers had high level of satisfaction whereas 36.25% of farmers had medium level of satisfaction towards mKRISHI® PAWS services.

Overall effectiveness of the Service

The overall effectiveness was obtained by developing the effectiveness index based on the above all five components. The obtained score was divided into five equal

Table 9 Distribution of farmers based on Ability to understand the message (N=240)

Category of timeliness	Class score	*f*	%
Poorly understood	60-68	20	8.333333
Fairly understood	68-76	5	2.083333
Moderately understood	76-84	14	5.833333
Easily understood	84-92	75	31.25
Very easily understood	92-100	126	52.5
Mean		90.31	
Standard deviation		10.56	

Table 10 Distribution of Farmers based on Satisfaction level (N=240)

Category of timeliness	Class score	*f*	%
Very low	66.66-71.33	11	4.583333
Low	71.33-76	31	12.91667
Medium	76-80.66	87	36.25
High	80.66-85.33	108	45
Very high	85.33-90	3	1.25
Mean		79.58	
Standard deviation		4.34	

Table 11 Distribution of farmers based on Effectiveness Index Scores (N=240)

Category of timeliness	Class score	F	%
Very low	74.01-77.27	6	2.5
Low	77.27-80.54	33	13.75
Medium	80.54-83.80	58	24.16667
High	83.80-87.07	60	25
Very high	87.07-90.34	83	34.58333
Mean		84.80	
Standard deviation		3.93	

groups ranging from very low effectiveness to very highly effectiveness of the mKRISHI® PAWS services. Table 11 revealed that 34.58% of the total farmers perceived that the mKRISHI® PAWS was very highly effective as a mean of getting information in their situation. 25% of farmers perceived it was highly effective in obtaining the information regarding their farming followed by 24.16% of farmers found it was medium effective in meeting their information need related to agriculture and allied sectors. World Bank (2012) also explained the benefits of mobile apps in the development of the agricultural sector as these apps providing the better, immediate and accurate access to information. Through these benefits we could achieve the target of development of hill and mountainous agriculture. Now a days, using of mobile apps are increasing in every sector as they are effective and have several benefits over the previous system. The convergence of mobile and other computing devices makes applications that started as computer-based functions accessible by handheld devices (Quing *et al*. 2011).

Among modern ICT modes, mobile phone has been most recent and widely accepted mode of delivering information (Mittal and Mehar 2012). Increasing mobile phone based services enhances the availability to knowledge and information in agriculture and meets the increasing information demand of farmers'. mKRISHI® PAWS is highly effective in the dissemination of agricultural related information to the small and marginal farmers of Dehradun district in Uttarakhand. These results were in line with the finding of Afroz and Singh (2013), who reported that Digital Green was highly effective in dissemination of agricultural related information to the farmers. It is in contrast with the findings of Mukherjee and Bahal (2011), who reported that Tata Kisan Sansar, were found to be medium in effectiveness by majority of the farmers. Similar report were also made by Hanumankar (2005) who concluded that nearly 84% of respondent have expressed their satisfaction from the advice provided through Kissan Call Centre. The result are in contrast with study of Meera *et al*. (2004) which found that nearly three fourth of respondent (73%) expressed medium level of personal effectiveness of *Gyandoot*.

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